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Phyllanthus tenellus Roxb. (Phyllanthaceae), a newly naturalising species in Morocco

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Abstract

We report the herbaceous plant *Phyllanthus tenellus* Roxb., a species native to tropical regions, from Morocco. This is the first time that the genus and species are reported from Morocco and continental North Africa. We found this species to be naturalising in several localities in north-western Morocco. A morphological description, the geographic distribution, and notes on the ecology of this species are provided. We present for the first time photographs of *P. tenellus* from continental North Africa.

Keywords

Alien flora, chorology, Euphorbiaceae s. lat., Malpighiales, Morocco, new records, North Africa

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Introduction

The vascular flora of Morocco remains one of the best studied and most comprehensively listed floras of continental North Africa on the southern shore of the Mediterranean Basin (e.g., Jahandiez and Maire 1931, 1932, 1934; Emberger and Maire 1941; Benabid 1985, 2000; Fennane and Ibn Tattou 1998, 2005, 2012; Benabid and Fennane1994; Médail and Quézel 1999; Fennane et al. 1999, 2007, 2014; Valdés et al. 2002; Ibn Tattou and Fennane 2008; Dobignard and Chatelain 2010, 2011a, 2011b, 2012, 2013; Chambouleyron 2012; Rankou et al. 2013, 2015, 2018). Nevertheless, investigators have been repeatedly surprised by the number of new additions to this flora. At least 16 taxa have been newly reported for the flora of Morocco and/or to science in the last nine years (Martínez-Rodríguez and Crespo 2013; Chambouleyron et al. 2014, 2015; Alonso et al. 2015; Dobignard 2015; Crespo et al. 2016; Brullo et al. 2017; Sant et al. 2017; Khamar et al. 2017, 2021; Essokne et al. 2018; Garcin 2019; Koch and Lemmel 2019; Chatelain et al. 2020; Homrani-Bakali and Peltier 2020; Homrani-Bakali and Susanna 2021). These new discoveries demonstrate the importance of field investigations and show that many phytogeographic sectors of the Moroccan territory still remain underrepresented in botanical surveys.

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During recent botanical surveys that we conducted in severals parts of the Morocco–North Atlantic phytogeographical region (Man, Man-3, Fennane and Ibn Tattou 1998) (Fig. 1) we encountered some unfamiliar specimens, which, after review of relevant literature (Coode et al. 1982; Ralimanana 2007; Silva and Sales 2007, 2008; Ralimanana and Hoffmann 2011), were found to correspond well to *Phyllanthus tenellus* Roxb. The genus *Phyllanthus* L. (Phyllanthaceae, Phyllanthoideae, Phyllantheae) has never previously been reported in Morocco (Vindt 1953, 1960; Valdés et al. 2002; Fennane et al. 2007; Dobignard and Chatelain 2013). Hence, our collection of *P. tenellus* represents the first records of the genus *Phyllanthus* and the species from Morocco.

Methods

Fieldwork was carried out from September 2020 to December 2021. Specimens of *Phyllanthus tenellus* were examined and photographed in the field. Identification was done by consulting the protologue (Roxburgh 1882), other descriptions, identification keys, and other references on *Phyllanthus* (Coode et al. 1982; Ralimanana 2007; Silva and Sales 2007, 2008; Ralimanana and Hoffmann 2011), as well as consulting images of the type specimen. We noted data on populations, distribution, geographic coordinates, and habitats during the field surveys. Voucher specimens were deposited in the National Herbarium of Scientific Institute-Rabat (RAB; acronym according to Thiers 2021). The nomenclature follows Govaerts (2021) and POWO (2021).

Results

***Phyllanthus tenellus* Roxb.** Flora Indica 2(3): 668 (Roxburgh 1882). Type: India. Calcutta, Wallich 7892 A (holotype K001128401; sheet available at http://specimens.kew.org/herbarium/K001128401).
Figure 2

New records. MOROCCO – **Rabat** • vicinity of Hay El Wifaq; 33°57′55″N, 007°23′37″W; 100 m a.s.l.; 06.IX.2020; H. Khamar and Lahcen Zidane leg.; RAB 113329 – **Mohammadia** • Roadside, 33°42′41.07″N, 007° 20′02.49″W; 51 m a.s.l.; 14.IX .2021; H. Khamar leg.; RAB113330 – **Kenitra** • near train station, 34°15′38.08″N,

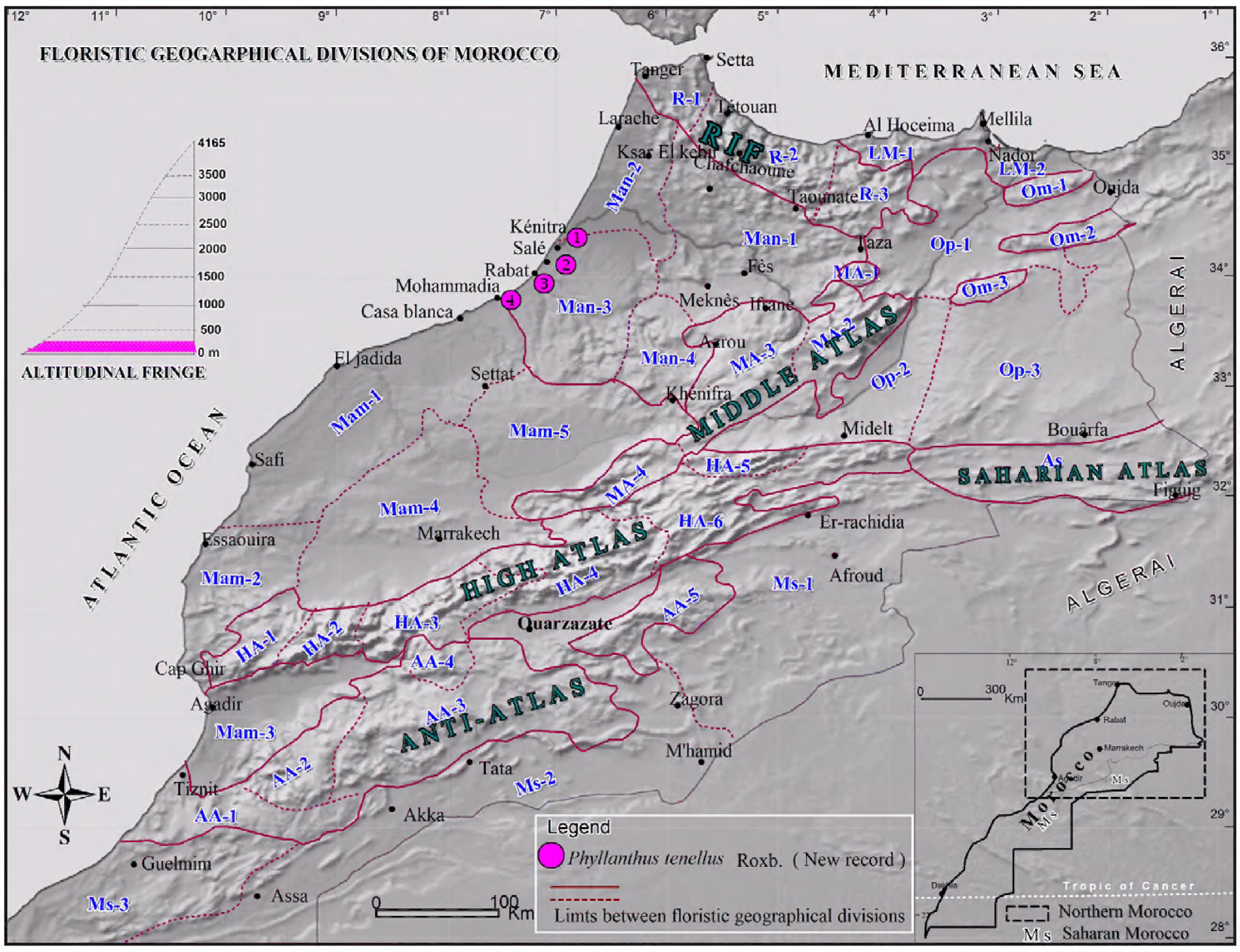
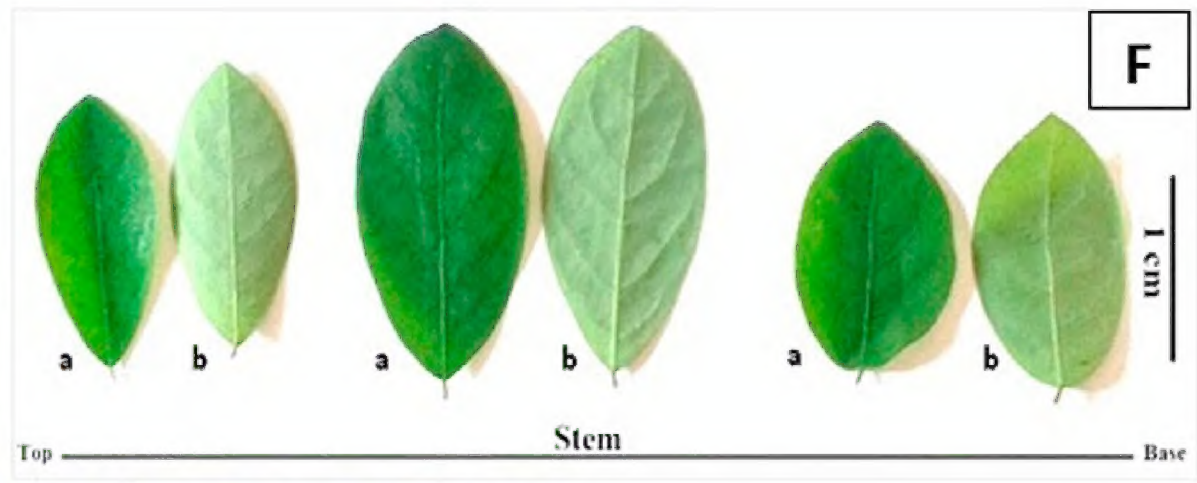
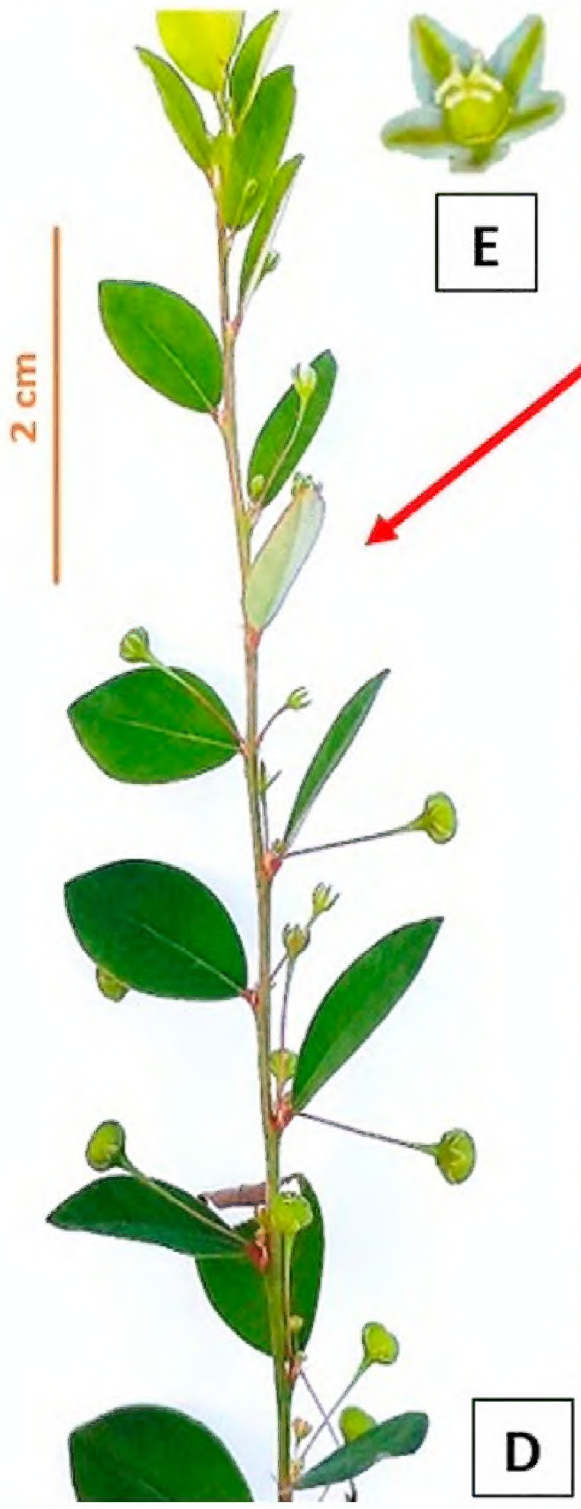
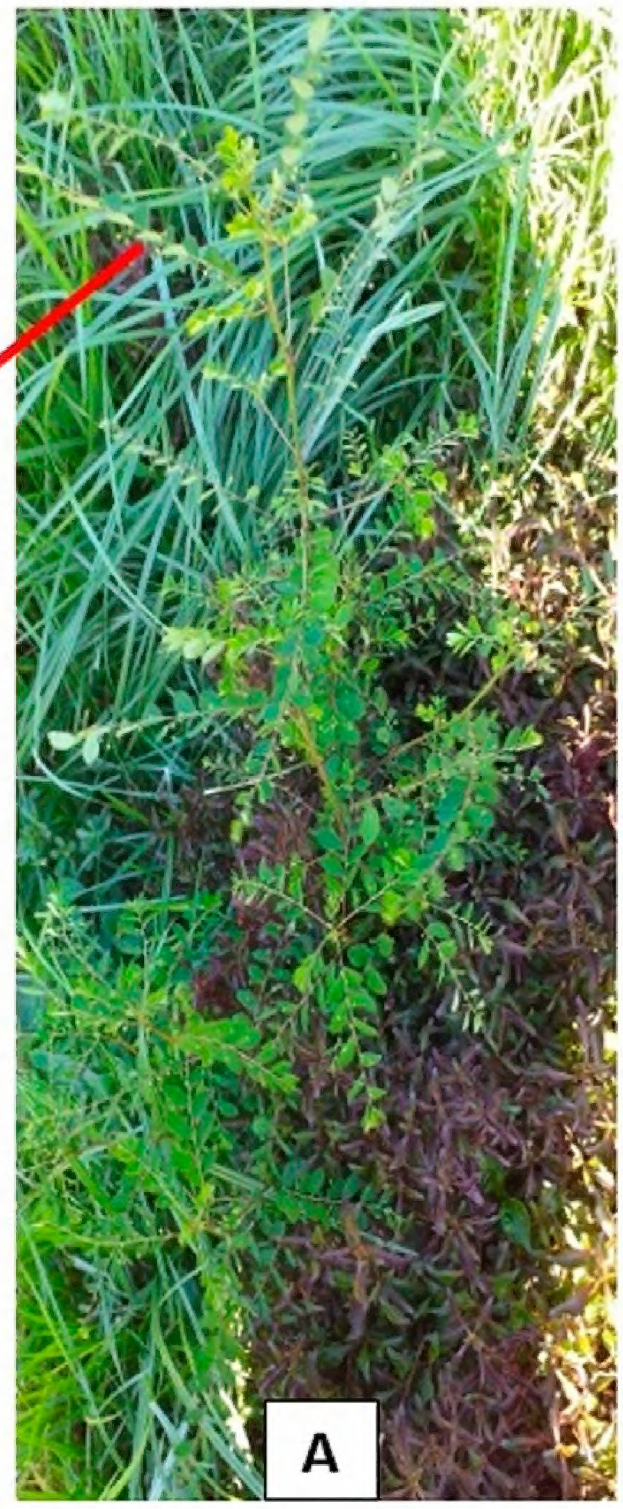


Figure 1. Distribution map of *Phyllanthus tenellus* in Morocco (pink circles), with the sampling sites: Site 1 (Kenitra), Site 2 (Sale), Site 3 (Rabat), and Site 4 (Mohammadia). Floristic geographical divisions of Morocco modified from Fennane and Ibn Tattou (1998), where HA = High Atlas Mountains, MA = Middle Atlas Mountains, R = Rif mountains; AA = Anti Atlas Mountains, Mam = Middle Atlantic of Morocco; Man = North Atlantic of Morocco, Ms = Saharan Moroccan, LM, Mediterranean Coast, Op = Eastern-lands, Om = Eastern Mountains and As = Saharian Atlas Mountains.







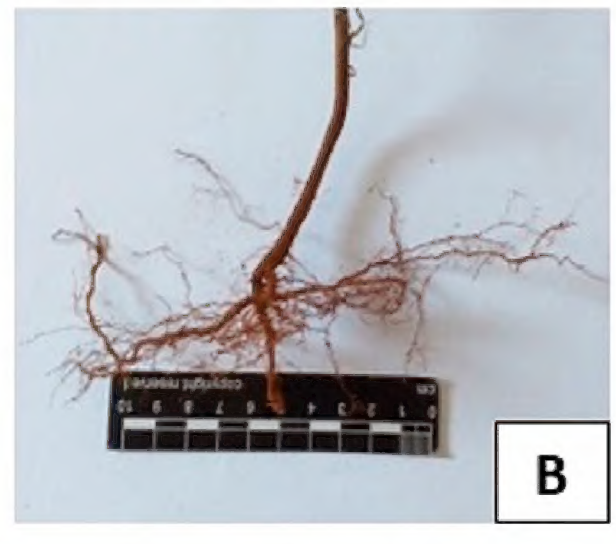


Figure 2. *Phyllanthus tenellus*. **A.** Habit and habitat. **B.** Root. **C.** Plant growing in a pot of ornamental plants next to a coffee shop. **D.** Flowering and fruiting plagiotropic branchlet. **E.** Flower. **F.** Leaf blades: (a) adaxial surface; (b) abaxial surface. **G.** Cataphylls (Cat) at the base of a plagiotropic branchlet. Photos by H. Khamar and O. Benkhnigue.

006°34′10.96″W; 20 m a.s.l.; 05.X.2021; H. Khamar leg.; RAB113331 • near train station; 34°15′38.08″N, 006°34′10.96″W; 32 m a.s.l.; 14.XI.2021; L. Zidane leg.; RAB113332 • Mohammed Diouri Avenue; 34°15′30″N, 006°35′01″W; 10 m a.s.l.; 15.X. 2021, O. Benkhnigue leg.; RAB113333 • Youssef Ben Tachfine Avenue; 34°15′40″N, 006°34′41″W; 11 m a.s.l.; 28.XII.2021; O. Benkhnigue leg.; RAB113334 – **Sale** • neighbourhood of Karima, 34°83′38″N, 006°77′38″W; 47 m a.s.l.; 30.VIII.2021; H. Khamar leg.; RAB113335.

Identification (Fig. 2). Annual herbaceous, monoecious. Stems terete, dressed, entirely glabrous or slightly scabridulous, usual height 15–50 cm but occasionally up to 150–200 cm high under favourable conditions; plagiotropic branches, terete, broad-leaved. Cataphylls triangular coriaceous, entire, glabrous. Leaves 6–25 × 4–11 mm; alternate, blade elliptical to obovate, margins entire, flat, wavy, attenuate at the base, acute to obtuse at apex, glabrous on both surfaces; petioles 0.5–1.0 mm long. Stipules not auriculate, membranous, persistent, triangular, reddish-brown, glabrous; petiole terete <1 mm long. Flowers: Solitary or 2 or 3 males and 1 or 2 females together, fruiting pedicels 4–10 mm long, perianth segments narrowly ovate, about 1 mm long, margins broad, white, not enlarging under fruit. Stamens: 5, filaments free. Capsule 1.5–2.0 mm diameter, globose,

greenish, smooth. Seeds about 1 mm long, brown, dorsally minutely tuberculate in longitudinal rows (see also Ralimanana 2007; Silva and Sales 2007; Ralimanana and Hoffmann 2011).

Distribution and habitat. *Phyllanthus tenellus* is native to Angola, Comoros, Madagascar, Mauritius, Mozambique, Réunion, Saudi Arabia, Tanzania, and Yemen (Coode et al. 1982; Zare et al. 2015; Hariri et al. 2020a), but it is regarded as an alien or naturalised plant in at least 30 countries (POWO 2021) (Fig. 3). Throughout its native lands, *P. tenellus* occupies varied habitats, including open forests, forest margins, littoral forests, and cultivated fields (Coode et al. 1982; Ralimanana 2007), at altitudes from sea level to about 2050 m a.s.l. (Ralimanana and Hoffmann 2011). Frequently, it is linked to wet places with deep, rotten humus and also in sandy alluvial flats along rivers (POWO 2021). However, where introduced, it usually has been observed in pots of ornamental exotic plants, near plant nurseries, in gardens, along roadsides, and at the edges of waterways (Crisafulli et al. 2011; Zare et al. 2015; Hariri et al. 2020b).

Near Morocco, this species has been reported from the Azores, Madeira, Cape Verde (Hansen and Sunding 1993; Schäfer 2003; Silva et al. 2005), and Canary islands (PadrònMederos et al. 2009), as well as Corsica (Jeanmonod 2000) and Italy (Crisafulli et al. 2011).

So far, *P. tenellus* has been observed from four sites in north-western of Morocco: Mohammadia, Rabat, Sale, and Kenitra (Fig. 1). The bioclimate in this zone is between subhumid to semi-arid Mediterranean with a temperate winter, annual rainfall of barely 400 mm, and average annual temperatures between 13 and 23 °C (Bendaanoun 1991). At the places surveyed, we found this species growing in urban ecosystems such as roadsides, gardens, and open areas, as well as in several pots of ornamental exotic plants exhibited next to coffee shops and restaurants. The altitudinal range of our new records is 8–100 m a.s.l.

In the vicinity of Mohammadia City, we found about 15 individuals *P. tenellus* living in reddish-brown sandy and clay-loam soil on a roadside where it was mixed with the following species: *Verbascum sinuatum* L., *Silybum marianum* (L.) Gaertn., *Ricinus communis* L., *Urtica urens* L., *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex A. Gray, *Solanum linnaeanum* Hepper & P.-M. L. Jaeger, *Solanum elaeagnifolium* Cav., *Diplotaxis tenuifolia* (L.) DC., and low grasses.

However, in the Rabat region, *P. tenellus* was found on clayey-sandy, more or less moist soil at about 100 m a.s.l. At this site, about 30 plants were found in association with *Mercurialis annua* L., *Euphorbia peplus* L., *E. lathyris* L., *E. paniculate* Desf., *E. terracina* L., *E. hirta* L., *Verbascum sinuatum* L., *Lupinus atlanticus* Dladst., *Lotus arenarius* Brot., *Ononis laxiflora* Desf., *Erigeron canadensis* L., *Plantago major* L., *Oxalis pes-caprae* L., *Emex spinosa* L., *Parietaria mauritanica* Durieu, *Urtica urens*, *Physalis philadelphica* Lam., and *Salpichroa origanifolia* (Lam.) Baillon.

In Sale, we first observed in pots with ornamental exotic plants, then eight individuals were located near plant nurseries on clayey-sandy soil.

In some places in Kenitra, we collected flowering *P. tenellus* plants from two wet locations at sea level and about 20 m a.s.l. on limestone and sandstone substrates. At these two sites, we inventoried over 50 plants of this species. Accompanying species include *Emex spinosa*, *Parietaria mauritanica* Durieu, *Diplotaxis tenuifolia*, *Oxalis pes-caprae*, *Gamochaeta antillana* (Urb.) Anderb. and *Salpichroa origanifolia*. In addition, numerous individuals have been observed in several pots of ornamental exotic plants at coffee shops and restaurants.

Discussion

Phyllanthus tenellus was first described by Roxburgh (1882) from material introduced from Mauritius in 1802 by Captain Tennant. In the most recent classification of the genus, supported by molecular phylogenetic data

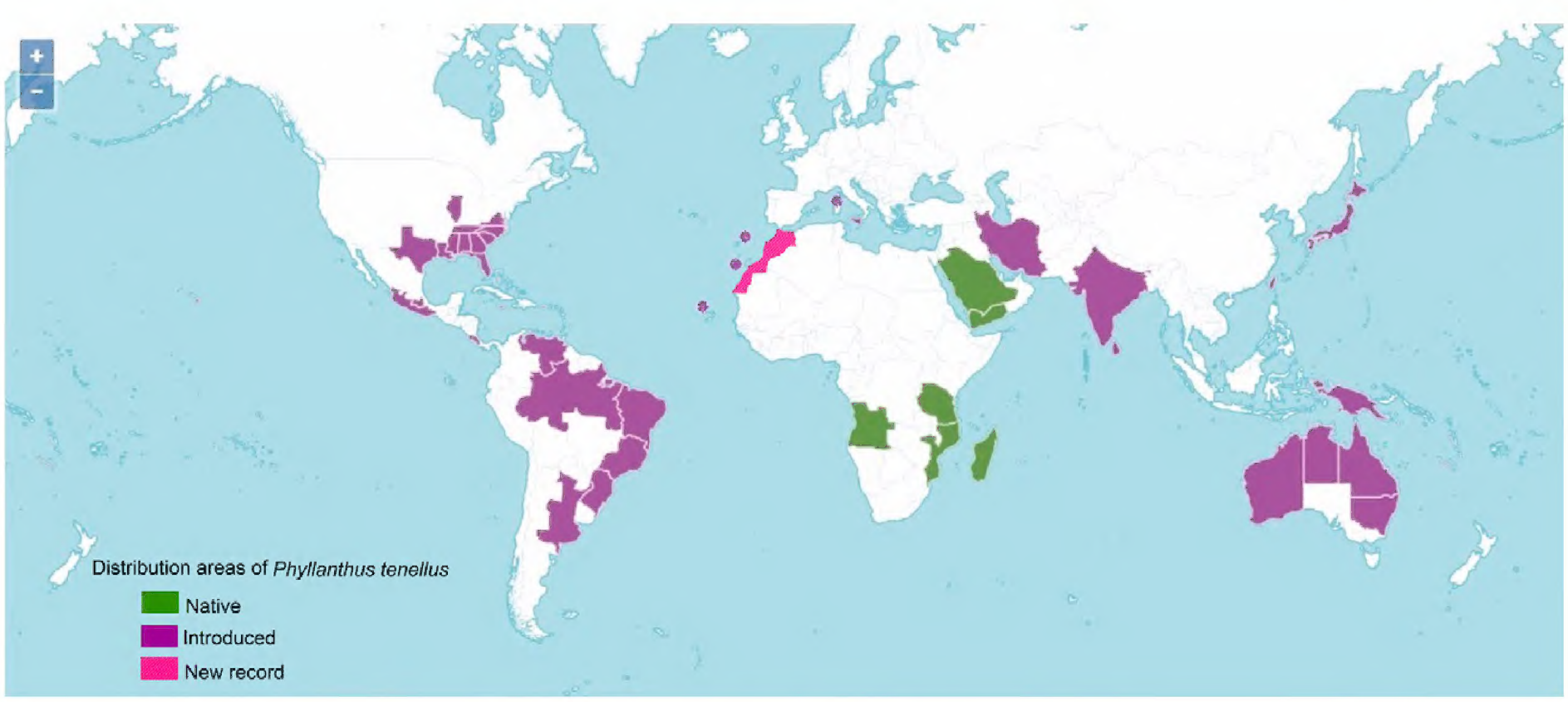


Figure 3. General distribution areas of *Phyllanthus tenellus* (modified from POWO 2021).

(Bouman et al. 2018, 2021), *P. tenellus* is classified in the pan-tropical subgenus *Tenellanthus* Jean F. Brune, but with its origin in Africa.

Dobignard and Chatelain (2013) treated Phyllanthaceae as a family among the 156 botanical families which constitute the vascular flora of Morocco, and with the Phyllanthaceae only represented there by one genus, *Andrachne* L. and three species—*A. aspera* Sprengel, *A. telephoioides* L., and the Moroccan endemic *A. maroccana* Ball. However, Fennane et al. (2007) classified this genus in Euphorbiaceae sensu lato. Our collections of *P. tenellus* from Morocco are the first time that this species and the genus *Phyllanthus* have been recorded from the country. Thus, we increase the number of genera of Phyllanthaceae in Morocco to two: *Andrachne* and *Phyllanthus*.

In our field surveys we frequently observed *P. tenellus* in pots of exotic ornamental plants. All four of the cities that we surveyed (Mohammadia, Rabat, Sale, and Kenitra) are known for the presence of nurseries of exotic and decorative plants imported from other countries, especially from tropical regions. Thus, *P. tenellus* is thought to have been introduced accidentally through the exotic plant trade as a contaminant in the soil and then escaped from gardens and nurseries into the wild, where it readily reproduced and spread. The introduction of *P. tenellus* to Morocco is consistent with several other areas where this species has also been introduced, for example, the Azores, Madeira, and the Cape Verde Islands (Hansen and Sunding 1993; Schäfer 2003; Silva et al. 2005), Corsica (Jeanmonod 2000), the Canary Islands (Padròn Mederos et al. 2009), Italy (Crisafulli et al. 2011), Iran (Zare et al. 2015), and Sumatra (Hariri et al. 2020a).

For some time now, biological invasions have been a very topical issue worldwide affecting flora and habitats (Laface et al. 2020; Musarella et al. 2020; Nagy et al. 2020; Rosati et al. 2020; Stinca et al. 2021; Tarkan et al. 2021). Africa is also interested in this issue (UICN/PACO 2013). However, although taxonomical research on naturalized and invasive plants has received occasional attention in some African countries, the diversity and abundance of invasive plants in relation to land use are still poorly documented (Foxcroft et al. 2010; Amah et al. 2019). In this context, inventory of newly recorded xenophytes is the main first step to the monitoring and potentially control of invasive alien plant species (Richardson and Wilgen 2004; Latombe, et al. 2017). In recent decades, plant invasions have not given importance in Morocco and the word "invasive" has rarely been mentioned in most documents and reports. Although there is no official list of invasive alien plants in Morocco, Tanji and Taleb (1997) did publish the first list of 12 plants. Currently, 29 invasive species are known (Bouhache and Taleb 2012), and more than half of these have invaded cultivated fields, while 27.6% were found in uncultivated land and the remaining 22.4% have invaded both environments (Taleb 2015; Ben-Ghabrit et al. 2019). The origins of the introductions are diverse; about 31% of Morocco's invasive alien plants come from the United States, about 38% from the Mediterranean Basin or Africa, and about 31% have their origins in Europe, Asia, and Australia (Ben-Ghabrit et al. 2019). The majority (66.6%) of these invasive alien plants in Morocco were introduced between 1930 and 2000, while the remaining species are neophytes.

The occurrence of a newly naturalising xenophyte, *P. tenellus*, reveals the need for continued botanical explorations of different ecosystems, with a special emphasis on disturbed ones, such as urban areas which are less attractive to researchers. Additionally, due to its ethnobotanical value and the richness of its bioactive ingredients (Silva et al. 2010, 2012; Victõrio et al. 2011; Sarin et al. 2014), *P. tenellus* may be found useful for future phytochemical and pharmacological investigations in Morocco.

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Authors' Contributions

Investigation: OB, HK, LZ. Supervision: AOT. Visualization: AD, OB. Methodology: HK, LZ. Validation: HK, AD, AOT. Writing – original draft: HK. Data curation: HK, LZ. Writing – review and editing: HK, AD, AOT.

References

Alonso MA, Crespo MB, Juan, A, Sáez L (2015) *Helianthemum* (sect. Helianthemum) *raskebdanae* (Cistaceae), a new species from northeastern Morocco. Phytotaxa 207 (3): 253–264. https://doi.org/10.11646/phytotaxa.207.3.3

Amah A, Johan O, Sêmihinva A, Laurent G, Koffi A, Valéry G (2019) Problématique des plantes envahissantes au sud du Togo (Afrique de l'Ouest): apport de l'analyse systémique paysagère et de la télédétection. Biotechnologie, Agronomie, Société et Environnement 23 (2): 88–103. https://doi.org/10.25518/1780-4507.17750

APD (2021) African Plant Database (version 3.4.0). Conservatoire et Jardin botaniques, Lange–Genève; South African National Biodiversity Institute, Pretoria. http://www.ville-ge.ch/musinfo/bd/cjb/africa/. Accessed on: 2022-01-05.

Benabid A (1985) Les ecosystèmes forestiers, pré-forestiers et steppiques du Maroc: diversité, répartition biogéographique et problèmes posés par leur aménagement. Forêt Méditerranéenne 7 (1): 53–64.

Benabid A (2000) Flore et écosystèmes du Maroc : évaluation et préservation de la biodiversité. Ibis Press, Paris, France, 359 pp.

Benabid A, Fennane M (1994) Connaissances sur la végétation du Maroc: phytogéographie, phytosociologie et séries de végétation. Lazaroa 14: 21–97.

Bendaanoun M (1991) Contribution à l'étude écologique de la végétation halophile, halohygrophile et hygrophile des estuaires, lagunes, deltas et sebkhas du littoral atlantique et méditerranéen et du domaine continental du Maroc. Doctoral thesis, Aix-Marseille

Université III, Marseille, France, 411 pp.
Ben-Ghabrit S, Bouhache M, Birouk A, Bon M C (2019) Quand les plantes exotiques envahissantes menacent l'agriculture et les écosystèmes. In : La protection des plantes: face aux défis actuels et en perspectives (proceedings). 26 et 27 Mars. Association Marocaine de Protection des Plantes, , Rabat, Morocco, 345–382.
Bouhache M, Taleb A (2012) New developments on invasive plants species of Morocco. Hands-on training workshop for weed risk assessment and weed risk management, Amman, Jordan, 22–26.
Bouman RW, Kessler PJ, Telford IR, Bruhl JJ, Strijk JS, Saunders RM, van Welzen PC (2021) Molecular phylogenetics of *Phyllanthus* sensu lato (Phyllanthaceae): towards coherent monophyletic taxa. Taxon 70 (1): 72–98. https://doi.org/10.1002/tax.12424
Bouman RW, Keβler PJA, Telford IRH, Bruhl JJ, Van Welzen PC (2018a) Subgeneric delimitation of the plant genus *Phyllanthus* L. (Phyllanthaceae). Blumea 63: 167–198. https://doi.org/10.3767/blumea.2018.63.02.14
Brullo S, Brullo C, Cambria S, Cristaudo A, Giusso del Galdo G (2017) *Bituminaria antiatlantica* (Psoraleeae, Fabaceae), a new species from Morocco. PhytoKeys 85: 109–124. https://doi.org/10.3897/phytokeys.85.12288
Chambouleyron M (2012) Contribution à la connaissance de la flore de la péninsule tingitane (Maroc). Lagascalia 32: 35–227.
Chambouleyron M, Bidat M, Léger JF (2015) *Sarcocapnos crassifolia* subsp. *simplicifolia* (Papaveraceae, Fumarioideae), a new narrow endemic taxon from northeastern Morocco. Annales Botanici Fennici 52: 205–210.
Chambouleyron M, Bidat M, Léger JF (2014) *Centaurea ibn-tattoui* (Asteraceae), a new narrow endemic species from northeastern Morocco. Phytotaxa 174 (3): 157–164. https://doi.org/10.11646/phytotaxa.174.3.4
Chatelain C, Andrieu F, Dobignard A (2020) A new Fabaceae species from western Sahara (Morocco): *Lotus zemmouriensis*. Candollea 75 (2): 189–192. https://doi.org/10.15553/c2020v752a3
Coode JE, Radliffe-Smith A, Scott AJ (1982) Euphorbiaceae. In: Flore des Mascareignes, La Réunion, Maurice et Rodrigues. 153–160-ème famille (Lauraceae à Euphorbiaceae). The Sugar Industry Research Institute, Mauritius / L'office de la recherche scientifique et technique outre-mer, Paris / the Royal Botanic Gardens, Kew, 1–32.
Crespo MB, Alonso MA, Vicente A, Villar J (2016) A new North African subspecies in the *Helianthemum origanifolium* aggregate (H. subg. Plectolobum, Cistaceae). Phytotaxa 252 (4): 263–272. https://doi.org/10.11646/phytotaxa.252.4.2
Crisafulli A, Picone RM, Zaccone S (2011) *Phyllanthus tenellus* (*Phyllanthaceae*) a new alien species naturalized to Sicily, first record for Italy. Flora Mediterranea 21: 293–297.
Dobignard A (2015) À propos de 3 taxons critiques de la flore du Maroc observés lors de la 49e session extraordinaire dans le Grand Atlas marocain. Evaxiana 2: 253–366.
Dobignard A, Chatelain C (2010–2013) Index synonymique de la flore d'Afrique du Nord, Volumes 1-5, Conservatoire et Jardin botaniques de la Ville de Genève, hors-série 11, a, b, c, d , 2251 pp.
Emberger L, Maire R (1941) Catalogue des plantes du Maroc. Tome 4. Imprimerie Minerva, Alger, 914 pp.
Essokne RS, Makhlouf MH, Jury SL (2018) *Adenocarpus ronaldii* Essokne & Jury. sp. nov. (Leguminosae). A new species from Morocco. American Journal of Life Science Researches 6 (1): 1–5.
Fennane M, Ibn Tattou M (1998) Catalogue des plantes vasculaires rares, menacées ou endémiques du Maroc. Bocconea 8: 1–243.
Fennane M, Ibn Tattou M (2005) Flore vasculaire du Maroc: inventaire et chorologie, volume 1. Travaux Institut Scientifique, Rabat, Série Botanique 37: 1–483.
Fennane M, Ibn Tattou M (2012) Statistics and comments on the current inventory of the vascular flora of Morocco. Bulletin de l'Institut Scientifique, Section Sciences de la Vie 34 (1): 1–9.
Fennane M, Ibn Tattou, M, Mathez J, Ouyahya, A, El Oualidi J (1999) Flore pratique du Maroc. Volume 1. Travaux Institut Scientifique, Rabat, Série Botanique 36: 1–527.
Fennane M, Ibn Tattou M, Mathez J, Ouyahya A, El Oualidi J (2007) Flore pratique du Maroc. Volume 2. Travaux Institut Scientifique, Rabat, Série Botanique 38:1–599.
Fennane M, Ibn Tattou M, El Oualidi J (2014) Flore pratique du Maroc. Volume 3. Travaux Institut Scientifique, Rabat, Série Botanique 40: 1–781.
Foxcroft LC, Richardson DM, Rejmánek M, Pyšek P (2010) Alien plant invasions in tropical and sub-tropical savannas: patterns, processes and prospects. Biological Invasions 12 (12): 3913–3933. https://doi.org/10.1007/s10530-010-9823-7
Garcin A (2019) Observations botaniques dans la région d'Abteh (Sahara Atlantique). Bulletin de l'Institut Scientifique, Section Sciences de la Vie 41: 59–71.
Govaerts R (2021) WCSP: World Checklist of Selected Plant Families (version Aug 2017). In: Roskov Y, Ower G, Orrell T, Nicolson D, Bailly N, Kirk PM, Bourgoin T, DeWalt RE, Decock W, Nieukerken E Van, Zarucchi J, Penev L (Eds.) Species 2000 & ITIS catalogue of life, 2019 annual checklist digital resource. Species 2000: Naturalis, Leiden, the Netherlands. http://www.catalogueoflife.org/annual-checklist/2019. Accessed on: 2021-12-04.
Hansen A, Sunding P (1993) Flora of Macaronesia: checklist of vascular plants. 4. Revised edition. Sommerfeltia 17: 112–113.
Hariri MR, Irsyam ASD, Mountara A (2020a) *Phyllanthus tenellus* Roxb. (Phyllanthaceae): a new record to the flora of Sumatera. Jurnal Ilmiah Biologi Eksperimen Dan Keanekaragaman Hayati 7 (2): 19–24. https://doi.org/10.23960/jbekh.v7i2.75
Hariri MR, Irsyam ASD, Irawan A, Anshori ZA, Mountara A, Irwanto RR (2020b). *Phyllanthus myrtifolius* (Moon ex Wight) Müll. Arg. and *Phyllanthus tenellus* Roxb. (Phyllanthaceae) in Java. Floribunda 6 (5): 188–194.
Homrani-Bakali A, Peltier JP (2020) *Gypsophila struthium* L. nouvelle espèce pour la flore du Maroc. Bulletin de l'Institut Scientifique, Section Sciences de la Vie 42: 59–62.
Homrani-Bakali A, Susanna, A (2021) *Centaurea peltieri* (Asteraceae), a new endemic species from the Oriental High Atlas of Morocco. Phytotaxa 523 (2): 192–198. https://doi.org/10.5281/zenodo.5587892
Ibn Tattou M, Fennane M (1989) Aperçu historique et état actuel des connaissances sur la flore vasculaire du Maroc. Bulletin Institut Scientifique, Rabat, Science de la Vie 13: 85–94.
Ibn Tattou M, Fennane M (2008) Flore vasculaire du Maroc: inventaire et chorologie. Volume 2. Travaux Institut Scientifique, Rabat, Série Botanique 39 :1–398.
Jahandiez E, Maire R (1931–1934) Catalogue des plantes du Maroc. Tomes 1, 2, 3. Imprimerie Minerva, Alger, 1012 pp.
Jeanmonod D (2000) Notes et contributions à la flore de Corse, XVI. Candollea 55: 41–74.
Khamar H, Benkhnigue O, Zidane L (2021) *Euphorbia hirta* (Euphorbiaceae): a new naturalized xenophyte in the vascular flora of Morocco. Flora Mediterranea 31: 199–206. https://doi.org/10.7320/flmedit31.199
Khamar H, Civeyrel L, Pelissier C, Badr D, El Oualidi J, Touhami-Ouazzani A (2017) *Verbascum ifranensis* (Scrophulariaceae), a new endemic species from Morocco. Phytotaxa. 295 (2): 132–140. https://doi.org/10.11646/phytotaxa.295.2.2
Koch MA, Lemmel C (2019) Zahora, a new monotypic genus from tribe Brassiceae (Brassicaceae) endemic to the Moroccan Sahara. PhytoKeys 135: 119–131. https://doi.org/10.3897/phytokeys.135.46946
Laface VLA, Musarella CM, Cano Ortiz A, Quinto Canas R, Cannavò S, Spampinato G (2020) Three new alien taxa for Europe and a chorological update on the alien vascular flora of Calabria (Southern Italy). Plants 9 (9): 1181. https://doi.org/10.3390/plants9091181
Latombe G, Pyšek P, Jeschke JM, Blackburn TM, Bacher S, Capinha C, Costello MJ, Fernández M, Gregory RD, Hobern D, Hui C, Jetz W, Kumschick S, McGrannachan C, Pergl J, Roy HE, Scalera R, Squires ZE, Wilson JRU, Winter M, Genovesi P, McGeoch MA (2017) A vision for global monitoring of biological invasions. Bi-

ological Conservation 213: 295–308. https://doi.org/10.1016/j.biocon.2016.06.013

Martínez-Rodríguez J, Crespo BM (2013) *Xiphion heracleanum* sp. nov. (Iridaceae) from Morocco. Nordic Journal of Botany 31: 90–93. https://doi.org/10.1111/j.1756-1051.2012.01582.x

Médail F, Quézel P (1999) The phytogeographical significance of S.W. Morocco compared to the Canary Islands. Plant Ecology 140: 221–244.

Musarella CM, Stinca A, Cano-Ortíz A, Laface VLA, Petrilli R, Esposito A, Spampinato G (2020) New data on the alien vascular flora of Calabria (southern Italy). Annali di Botanica 10: 55–66. https://doi.org/10.13133/2239-3129/14838

Padrón-Mederos MA, Guma IR, Santos-Guerra A, Reyes-Betancort JA (2009) Apuntes florísticos y taxonómicos para la flora de las islas Canarias. Acta Botanica Malacitana 34: 242–251.

POWO (2021) Plants of the world online. Royal Botanic Gardens, Kew. https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:354756-1. Accessed on: 2021-12-09.

Ralimanana H (2007) Systématique et biogéographie de *Phyllanthus* L. (*Phyllanthaceae*) de Madagascar. Doctoral thesis, Universite d'Antananarivo, Antananarivo, Madagascar, 318 pp.

Ralimanana H, Hoffmann P (2011) Taxonomic revision of *Phyllanthus* (Phyllanthaceae) in Madagascar and the Comoro Islands I: synopsis and subgenera *Isocladus*, *Betsileani*, *Kirganelia* and *Tenellanthus*. Kew Bulletin 66 (3): 331–365. https://doi.org/10.1007/s12225-011-9294-8

Rankou H, Culham A, Jury SL, Christenhusz MJM (2013) The endemic flora of Morocco. Phytotaxa 78:1–69. https://doi.org/10.11646/phytotaxa.78.1.1

Rankou H, D'Ambrosio U, Caruso E, Martin G (2018) Key biodiversity areas (KBAs) for plants in the Mediterranean region: Morocco. In: Valderrábano M, Gil T, Heywood V, de Montmollin B (Eds.) Conserving wild plants in the south and east Mediterranean region. IUCN & IUCN Centre for Mediterranean Cooperation, Gland, Switzerland, 45–50.

Rankou, H, Culham A, Taleb MS, Ouhammou A, Martin G, Jury SL (2015) Conservation assessments and Red Listing of the endemic Moroccan flora (monocotyledons). Botanical Journal of the Linnean Society 177: 504–575.

Richardson DM, Van Wilgen BW (2004) Invasive alien plants in South Africa: how well do we understand the ecological impacts? Working for water. South African Journal of Science 100 (1–2): 45–52.

Rosati L, Fascetti S, Romano VA, Potenza G, Lapenna MR, Capano A, Nicoletti P, Farris E, de Lange PJ, Del Vico E, Facioni L, Fanfarillo E, Lattanzi E, Cano-Ortiz A, Marignani M, Fogu MC, Bazzato E, Lallai E, Laface VLA, Musarella CM, Spampinato G, Mei G, Misano G, Salerno G, Esposito A, Stinca A (2020) New chorological data for the Italian vascular flora. Diversity 12 (1): 22. https://doi.org/10.3390/d12010022

Roxburgh W (1832) Flora Indica, ed. 2, volume 3. W. Thacker & Co., Calcutta & Parbury, Allan & Co., London, 838 pp.

Sant S, Leotard G, Dupre R, Crouzet N, Delelis N (2017) Contribution à la connaissance de la flore vasculaire du Maroc et particulièrement de l'Anti-Atlas. Poiretia 8: 1–22.

Sarin B, Verma N, Martín JP, Mohanty A (2014) An Overview of Important Ethnomedicinal Herbs of *Phyllanthus* species: present status and future prospects. The Scientific World Journal 2014: 839172. https://doi.org/10.1155/2014/839172

Schäfer H (2003) The chorology and diversity of the Azorean flora. Dissertationes Botanicae 374: 1–130.

Silva L, Pinto N, Press B, Rumsay F, Carine M, Henderson S, Sjögren E (2005) Lista das plantas vasculares (Pteridophyta e Spermatophyta). In: Borges PAV, Cunha R, Gabriel R, Martins AMF, Silva L, Vieira V (Eds.) A list of the terrestrial fauna (Mollusca and Arthropoda) and flora (Bryophyta, Pteridophyta and Spermatophyta) from the Azores, Direcção Regional do Ambiente, Universidade dos Açores, Horta, Angra do Heroísmo-Ponta Delgada, 131–156.

Silva MJ, Sales MF (2007) *Phyllanthus* L. (Phyllanthaceae) em Pernambuco, Brasil. Acta Botanica Brasilica 21: 79–98. https://doi.org/10.1590/s0102-33062007000100008

Silva MJ, Sales MF (2008) Sinopse do gênero *Phyllanthus* (Phyllanthaceae) no nordeste do Brasil. Rodriguésia 59 (2): 407–422. https://doi.org/10.1590/2175-7860200859214

Silva TCL, Filho JV, Amorim ELC, Souza IA, Albuquerque UP, Araújo EC (2012). Acute toxicity study of stone-breaker (*Phyllanthus tenellus* Roxb.). Revista de Ciencias Farmaceuticas Basica e Aplicada 33 (2): 205–210.

Silva TCL, Filho JV, Araújo J, Albuquerque UP, Lima V, Amorim ELC (2010) Antimicrobial activity of three species of *Phyllanthus* (quebra-pedra) and its commercial product. Journal of Nursing UFPE Online 4(1):93–97.

Stinca A, Musarella CM, Rosati L, Laface VLA, Licht W, Fanfarillo E, Wagensommer RP, Galasso G, Fascetti S, Esposito A, Fiaschi T, Nicolella G, Chianese G, Ciaschetti G, Salerno G, Fortini P, Di Pietro R, Perrino EV, Angiolini C, De Simone L, Mei G (2021) Italian Vascular Flora: new findings, updates and exploration of floristic similarities between regions. Diversity 13 (11): 600. https://doi.org/10.3390/d13110600

Taleb A (2015) Guide des principaux adventices des cultures du Maghreb (Maroc, Algérie et Tunisie). Dow AgroSciences. Rabat, Morocco, 225 pp.

Tanji A, Taleb A (1997) New weed species recently introduced into Morocco. Weed Research 37 (1): 27–30.

Tarkan AS, Tricarico E,Vilizzi L,Yoğurtçuoğlu B, Copp GH (2021) Risk of invasiveness of non-native aquatic species in the eastern Mediterranean region under current and projected climate conditions. The European Zoological Journal 88 (1): 1130–1143. https://doi.org/10.1080/24750263.2021.1980624

Thiers B (2021) Index herbariorum: a global directory of public herbaria and associated Staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/. Accessed on: 2021-12-25.

UICN/PACO (2013) Plantes invasives affectant les aires protégées d'Afrique de l'Ouest: gestion pour la réduction des risques pour la biodiversité. UICN/PACO, Ouagadougou, Burkina Faso, 92 pp.

Valdés B, Rejdali M, Achhal A, Jury SL, Montserrat JM (2002) Catalogue des plantes vasculaires du nord du Maroc, incluant clés d'identification. Volume I et II. CSIC, Madrid, Spain, 1007 pp.

Victõrio CP, Leal-Costa MV, Tavares ES, Kuster RM, Salgueiro Lage C L S (2011) Effects of supplemental UV-A on the development, anatomy and metabolite production of *Phyllanthus tenellus* cultured in vitro. Photochemistry and Photobiology 87 (3): 685–689. https://doi.org/10.1111/j.1751-1097.2011.00905.x

Vindt J (1953) Monographie des euphorbiacées du Maroc. Première partie: révision et systématique. Travaux Institut Scientifique Chérifien, Rabat, Série botanique 6 (2): 1–217.

Vindt J (1960) Monographie des euphorbiacées du Maroc. Deuxième partie: anatomie. Travaux Institut Scientifique Chérifien, Rabat, Série botanique 9:1–314.

Zare H, Amini T, Zare M (2015) *Phyllanthus tenellus* (Euphorbiaceae), a new record and naturalized species in Mandazaran. The Iranian Journal of Botany 21 (2): 129–132.